	Organizational Behaviour		Semester	5
	Course Code	**BVM501**	CIE Marks	100
	Teaching Hours/Week (L: T:P:S)	1:0:0:2	SEE Marks	0
	Total Hours of Pedagogy	25 (each module 05 hours)	Total Marks	100
	Credits	02	Exam Hours	03 Hours
	Examination type (SEE)	**Theory**		

Course Learning Objectives:

CLO1: Define organizational behaviour and its importance in contemporary organizations.
CLO2: Explain the foundations of individual behaviour, including personality, perception, attitudes, and values.
CLO3: Understand the concept of motivation and various theories explaining it.
CLO4: Describe the dynamics of group behaviour, including team development, decision-making, and conflict management.
CLO5: Explain the concepts of leadership, power, and politics within organizations.
CLO6: Understand the impact of organizational culture and structure on employee behaviour.
CLO7: Explain the process of organizational change and its impact on employees.

Module-1

Introduction to Organizational Behaviour

- Definition and scope of Organizational Behaviour (OB)
- Importance of OB
- Historical development of OB
- Challenges and opportunities in OB
- The role of OB for effective management

Module-2

Individual Behaviour

- Personality and its impact on organizational behaviour
- Perception and its role in organizational life
- Attitudes, values, and job satisfaction
- Motivation theories (Maslow, Herzberg, McClelland, etc.)
- Job design and work stress

Module-3

Interpersonal Behaviour

- Communication process and barriers
- Interpersonal skills (listening, feedback, negotiation)
- Conflict management styles and strategies
- Power and politics in organizations
- Leadership theories and styles

Module-4

Group Behaviour

- Group dynamics and stages of group development
- Group structure and processes
- Group decision-making
- Teamwork and collaboration
- Organizational culture and its impact on behaviour

Module-5

Organizational Structure and Design

- Organizational structure concepts (departmentalization, centralization, etc.)
- Organizational design (functional, divisional, matrix, etc.)
- Organizational change and development
- Organizational culture and climate

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

CO 1: Explain the impact of individual factors (personality, perception, attitudes, values) on behaviour.

CO 2: Apply concepts of motivation, learning, and job satisfaction to enhance employee performance.

CO 3: Analyse the role of emotions and stress in the workplace and develop strategies for management.

CO 4: Explain the concept of organizational culture and its impact on employee behaviour.

CO 5: Analyse the relationship between organizational structure, design, and effectiveness.

CO 6: Evaluate the role of change management in organizations.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks(18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation: 100 Marks

1. Two assignments tests;
2. First assignment after 30% completion of the syllabus for 50 marks
3. Second assignment after completion of 70% of the syllabus for 50 marks
4. The test after completion of 100% syllabus is conducted for 100 marks.
   Two questions are to be set for each module, there are 10 questions with 20 marks each. Each question may or may not have a sub-question. The students have to answer for 100 marks(05 full questions).
5. The sum of the two assignments is scaled down to 50.
6. The marks scored in the test shall be scaled down to 50.
7. The final marks of the course/subject is the sum of the Assignment marks and test marks

(Teacher may conduct the quiz or presentation or other suitable method of assignment in place of two or one assignment mentioned)

Semester-End Examination:

SEE is Not Applicable

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/109104030

Suggested Learning Resources:

Books

1. Luthans, F. (1989). Organizational Behaviour. London: McGraw Hill.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Role-playing and simulations
- Case studies and discussions
- Group projects and presentations
- Experiential learning

	Basics of Legal and HR Policies		Semester	5
	Course Code	**BVM502**	CIE Marks	100
	Teaching Hours/Week (L: T:P:S)	1:0:0:0	SEE Marks	0
	Total Hours of Pedagogy	12 (each module 2.5 hours)	Total Marks	100
	Credits	01	Exam Hours	03 Hours
	Examination type (SEE)	**Theory**		

Course Learning Objectives:

CLO1: Understand the legal environment of employment.
CLO2: Analyse the impact of labour laws on HR practices.
CLO3: Develop and implement effective HR policies.
CLO4: Manage employee relations within legal and ethical boundaries.
CLO5: Identify potential legal risks and develop mitigation strategies.

Module-1

Introduction to Labor Laws

- Overview of labour laws and their significance
- Historical development of labour legislation
- Key labour laws (vary by jurisdiction, but typically include):
- Employment Standards Act
- Industrial Disputes Act
- Minimum Wages Act
- Equal Remuneration Act
- Sexual Harassment Prevention Act
- Maternity Benefits Act
- Child Labor Act
- Social Security Acts

Module-2

Employment Contracts

- Types of employment contracts (permanent, temporary, contractual)
- Essential terms of an employment contract
- Contractual clauses (confidentiality, non-compete, intellectual property)
- Contractual violations and remedies

Module-3

Employee Rights and Responsibilities

- Fundamental rights of employees
- Employee duties and obligations
- Discrimination and harassment
- Whistleblower protection
- Workplace safety and health

Module-4

HR Policy Development and Implementation

- Principles of policy development
- Types of HR policies (employee handbook, code of conduct, disciplinary procedures, etc.)
- Policy communication and dissemination
- Policy review and update

Module-5

Legal Compliance and Risk Management

- Compliance audits and assessments
- Legal risks in HR (termination, discrimination, harassment, etc.)
- Developing risk mitigation strategies
- Role of HR in managing legal issues

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

CO 1: Identify key labour laws and regulations relevant to employment.

CO 2: Explain the implications of labour laws on HR practices.

CO 3: Recognize potential legal risks and liabilities associated with employment decisions.

CO 4: Understand the basic principles of employment contracts and their legal enforceability.

CO 5: Define the purpose and importance of HR policies.

CO 6: Develop HR policies aligned with legal requirements and organizational goals.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks(18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation: 100 Marks

1. Two assignments tests;
2. First assignment after 30% completion of the syllabus for 50 marks
3. Second assignment after completion of 70% of the syllabus for 50 marks
4. The test after completion of 100% syllabus is conducted for 100 marks.
   Two questions are to be set for each module, there are 10 questions with 20 marks each. Each question may or may not have a sub-question. The students have to answer for 100 marks(05 full questions).
5. The sum of the two assignments is scaled down to 50.
6. The marks scored in the test shall be scaled down to 50.
7. The final marks of the course/subject is the sum of the Assignment marks and test marks

(Teacher may conduct the quiz or presentation or other suitable method of assignment in place of two or one assignment mentioned)

Semester-End Examination:

SEE is Not Applicable

Web links and Video Lectures (e-Resources):

Suggested Learning Resources:

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents-related activities (Activity-based discussions)
- For active participation of students instruct the students to prepare Flowcharts.
- Organising group-wise discussions on topics.
- Quizzes and Discussions, Seminars and assignments.

	Design of Mechatronics System		Semester	5
	Course Code	**BVM503**	CIE Marks	50
	Teaching Hours/Week (L: T:P:S)	2:0:0:2	SEE Marks	50
	Total Hours of Pedagogy	40 (each module 08 hours)	Total Marks	100
	Credits	03	Exam Hours	03 Hours
	Examination type (SEE)	**Theory**		

Course Learning Objectives:

CLO 1. Gain knowledge of basics of Mechatronics system design and sensors.
CLO 2. Understanding various techniques of Mechatronics system design for solving engineeringproblems.
CLO 3. Understanding Dynamic responses of systems and Fault detection techniques

Module-1

Introduction to mechatronics System Design: Mechatronics Definition, integrated design issues in Mechatronics, the Mechatronics design process, the key elements, Application of Mechatronics. Sensors in Mechatronics: sensors for motion and position measurement. Force and pressure sensors. Sensors for temperature measurements.

Module-2

Modelling and Simulation of Physical Elements: Operator notation and transfer functions, Block diagrams, manipulations and simulation, block diagram modelling- Direct method and analogy approach, Electrical systems, Mechanical systems(Rotational and Translational), electrical Mechanical Coupling, Fluid systems.

Module-3

Signal Conditioning and Real time Interfacing: Introduction, elements of Data Acquisition and Control System, Transducers and Signal Conditioning, Devices for data conversion, Data conversion process, Application software.

Module-4

Mechanical System Design

- **Basic Mechanics:**
  - Kinematics and dynamics.
  - Mechanisms and linkages.
  - Structural design considerations.
- **Mechanical Components:**
  - Gears, bearings, shafts.
  - Materials selection.
- **Integration of Mechanical and Electrical Components:**
  - Mounting sensors and actuators.
  - Cable management.

Module-5

System Integration and Control

- **System Modeling:**
  - Block diagrams and system representation.
  - Introduction to transfer functions.
- **Control Systems:**
  - Open-loop and closed-loop control.
  - Basic control strategies (PID control).
  - System response analysis.
- **System Integration:**
  - Interfacing hardware and software components.
  - Testing and debugging.
  - Basic system calibration.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

CO1. Discuss about Mechatronics design process and select the sensor and Actuator for a Mechatronics application

CO2. Explain Modelling and Simulation of mechanical Elements, electrical Elements and fluid systemthe sensors in mechatronics systems and Fault detection techniques in Mechatronics.

CO3. Understand the elements of Data Acquisition and Control System, Convert the data in real time interfacing

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks(18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation: 50 Marks

1. Two assignments tests;
2. First assignment after 30% completion of the syllabus for 50 marks
3. Second assignment after completion of 70% of the syllabus for 50 marks(May be quiz or other method of assignments)
4. The test after completion of 90 % syllabus is conducted for 100 marks.
5. The sum of the two assignments is scaled down to 25.
6. The marks scored in the test shall be scaled down to 25.
7. The final marks of the course/subject is the sum of the Assignment marks and test marks **(The class teacher may conduct the quiz/presentations/other suitable methods of assignment in place of two or one test)**

Semester-End Examination: 50 Marks

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Marks scored will be scaled down to 50 marks

Web links and Video Lectures (e-Resources):

https://onlinecourses.nptel.ac.in/noc21_me129/preview

https://nptel.ac.in/

Suggested Learning Resources:
Books

- Mechatronics System Design by Devdas Shetty and Richard A Kolk, Second edition, Thomson LearningPublishing Company, Vikas publishing house, 2001.
- Shetty and Kolk "Mechatronics System Design"- Cengage Learning, 2010

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

- Quiz
- Presentations
- Group Activity

	Micro Electro Mechanical Systems		Semester	5
	Course Code	**BVM504**	CIE Marks	50
	Teaching Hours/Week (L: T:P:S)	2:0:2:2	SEE Marks	50
	Total Hours of Pedagogy	50 (each module 10 hours)	Total Marks	100
	Credits	04	Exam Hours	03 Hours
	Examination type (SEE)	**Theory**		

Course Learning Objectives:

CLO 1. Define and contextualize Micro Electro Mechanical Systems (MEMS), encompassing their historical development, scale considerations, interdisciplinary nature, and the advantages and limitations of their application across diverse industries.

CLO 2. Explain the fundamental materials and microfabrication techniques used in MEMS, including material selection, cleanroom processes, and the creation of basic MEMS device structures.

CLO 3. Apply the principles of mechanics at the microscale, including scaling laws and Finite Element Analysis (FEA), to analyze the behavior of MEMS devices like cantilevers and diaphragms.

CLO 4. Describe the operational principles of MEMS sensors and actuators, and identify their applications in various fields, while also recognizing emerging trends like NEMS and BioMEMS.

Module-1

Introduction to Micro and Smart systems:

- **Definition and Scope:**
  - What are MEMS?
  - Scale considerations: micro vs. macro.
  - Applications of MEMS across various industries (automotive, biomedical, consumer electronics, etc.).
- **Historical Overview:**
  - Brief history of miniaturization.
  - Key milestones in MEMS development.
- **Advantages and Limitations of MEMS:**
  - Benefits: miniaturization, low power consumption, integration, batch fabrication.
  - Challenges: fabrication complexity, packaging, reliability.
- **Interdisciplinary Nature of MEMS:**
  - Material science, solid mechanics, electrical engineering, fluid mechanics, and chemistry.

Module-2

Materials and Fabrication

- **Materials for MEMS:**
  - Silicon: properties and advantages.
  - Other materials: polymers, metals, ceramics.
  - Material selection based on application.
- **Microfabrication Techniques:**
  - Overview of cleanroom environment.
  - Photolithography: principles and process.
  - Etching: wet and dry etching techniques.
  - Thin film deposition: sputtering, evaporation, CVD.
  - Surface micromachining and bulk micromachining.
  - Introduction to additive manufacturing in MEMS.
- **Basic Fabrication Process Flow:**
  - A simple example of a MEMS device fabrication sequence.

Module-3

Mechanics of MEMS

- **Scaling Laws:**
  - How forces and physical phenomena scale down to the microscale.
  - Surface forces vs. volume forces.
- **Mechanics of Materials at the Microscale:**
  - Stress and strain.
  - Beam bending and deflection.
  - Cantilevers and diaphragms.
  - Resonance and vibration.
- **Finite Element Analysis (FEA) Introduction:**
  - Basic concepts of FEA for MEMS design.

Module-4

Sensors and Actuators

- **Sensing Principles:**
  - Capacitive, piezoresistive, piezoelectric sensing.
  - Thermal sensing.
- **MEMS Sensors:**
  - Accelerometers: principles and applications.
  - Pressure sensors: principles and applications.
  - Gyroscopes: principles and applications.
  - Microphones.
- **Actuation Principles:**
  - Electrostatic actuation.
  - Thermal actuation.
  - Piezoelectric actuation.
- **MEMS Actuators:**
  - Micro-motors.
  - Micro-valves.
  - Micro-pumps.

Module-5

Applications and Future Trends

- **Applications in specific fields:**

- Biomedical MEMS (drug delivery, lab-on-a-chip).
- Automotive MEMS.
- Consumer electronics MEMS.
- Aerospace MEMS.

- **Emerging Trends:**
  - NEMS (Nano Electro Mechanical Systems).
  - BioMEMS.
  - Integration with IoT.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

CO1. Understand the fundamentals of MEMS, including their definition, historical development, advantages, limitations, and interdisciplinary nature, and recognize their diverse applications across various industries.

CO2. Gain knowledge of materials and microfabrication techniques used in MEMS, including material selection, photolithography, etching, deposition, and the basic fabrication process flow.

CO3. Apply principles of mechanics, including scaling laws and material behavior at the microscale, to analyze and design MEMS devices, and understand the basic concepts of Finite Element Analysis (FEA) for MEMS design.

CO4. Comprehend the principles of sensing and actuation in MEMS, identify various types of MEMS sensors and actuators, and recognize emerging trends and applications of micro and smart systems in diverse fields.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks(18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation: 50 Marks

1. Two assignments tests;
2. First assignment after 30% completion of the syllabus for 50 marks
3. Second assignment after completion of 70% of the syllabus for 50 marks(May be quiz or other method of assignments)
4. The test after completion of 90 % syllabus is conducted for 100 marks.
5. The sum of the two assignments is scaled down to 25.
6. The marks scored in the test shall be scaled down to 25.
7. The final marks of the course/subject is the sum of the Assignment marks and test marks **(The class teacher may conduct the quiz/presentations/other suitable methods of assignment in place of two or one test)**

Semester-End Examination: 50 Marks

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Marks scored will be scaled down to 50 marks

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/117105082

Suggested Learning Resources:

Books

- MEMS- NitaigourPremchandMahalik, TMH 2007.
- MEMS & Microsystems: Design and Manufacture, Tai-Ran Hsu, Tata Mc-Graw-Hill.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

1. Students are segregated in groups of 5members made to Prepare models of FCC structure of Silicon and Patterns to demonstrate the process of Photolithography.
2. Students are segregated in groups of 5members made to Prepare models of Cantilever Beam to analyze the vibration control and Patterns to demonstrate the process of Etching.

3.Quiz

	Industry 4.0		Semester	5
	Course Code	**BVM505**	CIE Marks	50
	Teaching Hours/Week (L: T:P:S)	1:0:0:2	SEE Marks	50
	Total Hours of Pedagogy	25 (each module 10 hours)	Total Marks	100
	Credits	02	Exam Hours	03 Hours
	Examination type (SEE)	**Theory**		

Course Learning Objectives:

CLO1: Understand the concept of Industry 4.0: Define and explain the key characteristics, drivers, and potential impacts of Industry 4.0.
CLO2: Identify core technologies: Describe the role of key technologies such as IoT, AI, Big Data, cloud computing, and cyber-physical systems in Industry 4.0.
CLO3: To provide an overview of Additive Manufacturing processes, systems and applications.
CLO4: Understand the basic ideas and techniques in the design of intelligent systems.
CLO5: Explain the historical context of industrial revolutions leading to Industry 4.0.
CLO6: Identify the key components of a smart factory.

Module-1

Introduction to Industry 4.0

- Introduction to Industry 4.0
- The history of Industry 4.0
- The key technologies of Industry 4.0
- The benefits of Industry 4.0
- The challenges of Industry 4.0

Cyber-Physical Systems

- Introduction to cyber-physical systems
- The components of cyber-physical systems
- The applications of cyber-physical systems
- The challenges of cyber-physical systems

Module-2

The Internet of Things (IoT)

- Introduction to IoT
- The components of the Internet of Things
- The applications of the Internet of Things
- The challenges of the Internet of Things

Big Data and Analytics

- Introduction to big data
- The characteristics of big data
- The applications of big data
- The challenges of big data

- Big data analytics tools and techniques

Data Analytics in Manufacturing: Introduction, Power Consumption in manufacturing, Anomaly Detection in Air Conditioning, Smart Remote Machinery Maintenance Systems with Komatsu, Quality Prediction in Steel Manufacturing.

Module-3

Advances Robotics

- Introduction to robotics
- The types of robots
- The applications of robots
- The challenges of robots

Cloud Computing

- Introduction to cloud computing
- The types of cloud computing
- The applications of cloud computing
- The challenges of cloud computing

Module-4

Additive Manufacturing

- Introduction to additive manufacturing
- The types of additive manufacturing
- The applications of additive manufacturing
- The challenges of additive manufacturing

Advances in Virtual Factory Research and Applications, The State of Art, The Virtual Factory Software , Limitations of the Commercial Software

Module-5

Augmented Reality: The Role of Augmented Reality in the Age of Industry 4.0, Introduction, AR Hardware and Software Technology, Industrial Applications of AR, Maintenance , Assembly, Collaborative Operations , Training.

Smart Factories: Introduction, Smart factories in action, Importance, Real world smart factories, The way forward.

A Roadmap: Digital Transformation, Transforming Operational Processes, Business Models, Increase Operational Efficiency, Develop New Business Models.

Industry 4.0 Case Studies

- Case studies of successful Industry 4.0 implementations
- Case studies of failed Industry 4.0 implementations
- Lessons learned from Industry 4.0 case studies

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

CO1:Understand the opportunities, challenges brought about by Industry 4.0 for benefits of organizations and individuals
CO2:Analyze the effectiveness of Smart Factories, Smart cities, Smart products and Smart services
CO3:Apply the Industrial 4.0 concepts in a manufacturing plant to improve productivity and profits
CO4:Evaluate the effectiveness of Cloud Computing in a networked economy

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks(18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation: 50 Marks

1. Two assignments tests;
2. First assignment after 30% completion of the syllabus for 50 marks
3. Second assignment after completion of 70% of the syllabus for 50 marks(May be quiz or other method of assignments)
4. The test after completion of 90 % syllabus is conducted for 100 marks.
5. The sum of the two assignments is scaled down to 25.
6. The marks scored in the test shall be scaled down to 25.
7. The final marks of the course/subject is the sum of the Assignment marks and test marks
   (The class teacher may conduct the quiz/presentations/other suitable methods of assignment in place of two or one test)

Semester-End Examination: 50 Marks

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Marks scored will be scaled down to 50 marks

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/

https://onlinecourses.nptel.ac.in/noc20_cs69/preview

https://onlinecourses.nptel.ac.in/noc21_me115/preview

https://onlinecourses.nptel.ac.in/noc20_mg70/preview

Suggested Learning Resources:
Books

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things"
2. Sabrie Soloman, 3D Printing & Design, Khanna Book Publishing Company, New Delhi, 2020

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

- Demonstrate a sensor based application
- IoT and Sensor Networks: Building and deploying IoT devices, collecting and analyzing sensor data.
- Robotics and Automation: Programming and operating industrial robots, integrating automation systems.
- Additive Manufacturing (3D Printing): Designing and producing prototypes, understanding material properties.
- Augmented and Virtual Reality: Developing AR/VR applications for training, maintenance, and design.
- Cybersecurity: Implementing cybersecurity measures, responding to cyber threats.

	CNC Fundamentals and Programming		Semester	5
	Course Code	**BVM506**	CIE Marks	100
	Teaching Hours/Week (L: T:P:S)	1:0:2:2	SEE Marks	00
	Total Hours of Pedagogy	40(Each Module 08 hours)	Total Marks	100
	Credits	03	Exam Hours	03 Hours
	Examination type (SEE)	**Theory**		

Course Learning Objectives:

CLO1: Understand CNC principles: Comprehend the basic concepts of CNC technology, including numerical control, motion control, and closed-loop systems.

CLO2: Learn CNC machine components: Identify and understand the functions of various CNC machine components (spindle, axis, tool changer, coolant system, etc.).

CLO3: Grasp CNC programming: Acquire knowledge of G-code and M-code programming, including motion commands, tool selection, and auxiliary functions.

Module-1

Introduction to CNC Machining

- Understanding CNC technology and its applications
- Comparison of CNC and conventional machining
- CNC machine components and their functions
- Safety procedures in CNC machining

Module-2

CNC Programming Basics

- Coordinate systems (absolute, incremental)
- Basic G and M codes
- Part programming for simple shapes
- Tool path generation

Module-3

CNC Machine Operation

- CNC machine setup and preparation
- Tooling and work holding
- Machine calibration and zero offset
- Program execution and monitoring

Module-4

CNC Milling

- Milling machine components and operations
- CNC milling programming (2D and 3D)
- Cutting tool selection and parameters

	• Work holding for milling
	Module-5
	CNC Turning • Lathe machine components and operations • CNC turning programming • Cutting tool selection and parameters • Work holding for turning

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

CO 1: CNC machine components and functions: Understand the construction and operation of CNC machine components (e.g., spindle, axis, controller).

CO 2: Coordinate systems and motion control: Apply coordinate systems (Cartesian, polar) and understand motion control principles.

CO 3: Tooling and workholding: Select appropriate cutting tools and workholding devices for different machining operations.

CO 4: Cutting parameters and machining processes: Determine optimal cutting parameters and perform various machining operations (e.g., milling, turning, drilling).

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks(18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation: 100 Marks

1. Two assignments tests;
2. First assignment after 30% completion of the syllabus for 50 marks
3. Second assignment after completion of 70% of the syllabus for 50 marks
4. The test after completion of 100% syllabus is conducted for 100 marks.
   Two questions are to be set for each module, there are 10 questions with 20 marks each. Each question may or may not have a sub-question. The students have to answer for 100 marks(05 full questions).
5. The sum of the two assignments is scaled down to 50.
6. The marks scored in the test shall be scaled down to 50.
7. The final marks of the course/subject is the sum of the Assignment marks and test marks

(Teacher may conduct the quiz or presentation or other suitable method of assignment in place of

two or one assignment mentioned)
Semester-End Examination: SEE is Not Applicable
Web links and Video Lectures (e-Resources):
Suggested Learning Resources: **Books** 1. CNC fundamentals and programming by P. M Agrawal
Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning •